CLAIMS

1. A drive unit for a compressor having a motor **(6)**,

the drive unit comprising:

detecting means **(16, 17)** for detecting the current and/or voltage of said motor **(6)**; and

prediction means **(28)** for predicting an internal condition based on detection values obtained by said detecting means **(16, 17)**.

2. The drive unit for a compressor according to claim 1,

wherein the prediction means **(28)** has identification means **(20)** for identifying a parameter of a motor model from the detection values obtained by the detecting means **(16, 17)**, and derivation means **(21)** for deriving the internal condition based on the parameter identified by said identification means **(20)**.

3. The drive unit for a compressor according to claim 1,

wherein the internal condition predicted by the prediction means **(28)** is shaft abnormalities or poor lubrication.

4. The drive unit for a compressor according to claim 1,

wherein the internal condition predicted by the prediction means **(28)** is motor temperature.

5. The drive unit for a compressor according to claim 1,

wherein the motor **(6)** is a brushless DC motor.

6. A refrigerator having a refrigerant circuit provided with a compressor **(1)** including a motor **(6)**,

the refrigerator comprising:

detecting means **(16, 17)** for detecting the current and/or voltage of said motor **(6)**; and

prediction means **(28)** for predicting an internal condition of the

compressor **(1)** based on detection values obtained by said detecting means **(16, 17)**.

7. The refrigerator according to claim 6,

wherein said prediction means **(28)** has identification means **(20)** for identifying a parameter of a motor model from the detection values obtained by the detecting means **(16, 17)**, and derivation means **(21)** for deriving the internal condition of the compressor **(1)** based on the parameter identified by the identification means **(20)**.

8. The refrigerator according to claim 6,

wherein said motor **(6)** is a brushless DC motor.

9. The refrigerator according to claim 7,

wherein the parameter identified by said identification means **(20)** is motor driving torque.

10. The refrigerator according to claim 6,

wherein the internal condition predicted by said prediction means **(28)** is the high refrigerant pressure or low refrigerant pressure of the refrigerant circuit.

11. The refrigerator according to claim 9,

wherein said refrigerant circuit is provided with refrigerant detecting means **(22, 23)** for detecting a refrigerant state, and

wherein said derivation means **(21)** derives the high refrigerant pressure or low refrigerant pressure of the refrigerant circuit based on the motor driving torque identified by the identification means **(20)** and the refrigerant state detected by the refrigerant detecting means **(22, 23)**.

12. The refrigerator according to claim 9,

wherein said refrigerant circuit is provided with the refrigerant detecting means **(22, 23)** for detecting a refrigerant state, and

wherein the derivation means **(21)** is formed such that the relationship between motor driving torque corresponding to the refrigerant temperature and/or refrigerant pressure of the refrigerant circuit and the degree of suction superheat of the compressor **(1)** is set beforehand and such that the degree of suction superheat of the compressor **(1)** is derived based on the motor driving torque identified by the identification means **(20)** and the refrigerant state detected by the refrigerant detecting means **(22, 23)**.

13. The refrigerator according to claim 6,

wherein the internal condition predicted by the prediction means **(28)** is occurrence of an impact load within the compressor **(1)**.

14. The refrigerator according to claim 13,

wherein the detection value obtained by the detecting means **(16)** is the current of the motor **(6)**, and

wherein the prediction means **(28)** predicts occurrence of an impact load from the higher harmonic component of the detection current obtained by the detecting means **(16)**.

15. The refrigerator according to claim 14,

wherein the prediction means **(28)** predicts occurrence of an impact load from the amount of distortion in the sine wave of the higher harmonic component of the detection current.

16. The refrigerator according to claim 14,

wherein the prediction means **(28)** predicts occurrence of an impact load when the higher harmonic component of the detection current is greater than a preset reference value.

17. The refrigerator according to claim 16,

wherein the reference value for the prediction means **(28)** is set in

accordance with the refrigerant temperature and/or refrigerant pressure of the refrigerant circuit.

18. The refrigerator according to claim 6,

wherein the internal condition predicted by the prediction means **(28)** is poor lubrication or liquid compression in the compressor **(1)**.

19. The refrigerator according to claim 18,

wherein the detection value obtained by the detecting means **(16)** is the current of the motor **(6)**, and

wherein the prediction means **(28)** predicts the poor lubrication or liquid compression of the compressor **(1)**, based on the increasing rate of the detection current obtained by the detecting means **(16)**.

20. The refrigerator according to claim 19,

wherein the refrigerant circuit is equipped with refrigerant detecting means **(22, 23)** for detecting a refrigerant state, and

wherein the prediction means **(28)** is formed such that a stationary current for the motor **(6)** in its steady state is set based on the detection current detected by the detecting means **(16)** and based on the refrigerant state detected by the refrigerant detecting means **(22, 23)** and such that the poor lubrication or liquid compression of the compressor **(1)** is predicted by making a comparison between said stationary current and the detection current detected by the detecting means **(16)**.

21. The refrigerator according to claim 9,

wherein the prediction means **(28)** predicts poor lubrication or liquid compression in the compressor **(1)** based on an increase in motor driving torque which exceeds a specified value.

22. The refrigerator according to claim 21,

wherein the refrigerant circuit is equipped with refrigerant detecting means **(22, 23)** for detecting a refrigerant state, and

wherein the prediction means **(28)** is formed such that a stationary torque for the motor **(6)** in its steady state is set based on the motor driving torque identified by the identification means **(20)** and based on the refrigerant state detected by the refrigerant detecting means **(22, 23)** and such that the poor lubrication or liquid compression of the compressor **(1)** is predicted by making a comparison between said stationary torque and the motor driving torque identified by the identification means **(20)**.

23. The refrigerator according to claim 9,

wherein the prediction means **(28)** outputs information on the internal condition of the compressor **(1)** which has been predicted.

24. The refrigerator according to claim 9, further comprising:

protection means **(29)** for protecting the compressor **(1)** based on information on the internal condition of the compressor **(1)** predicted by the prediction means **(28)**.

25. The refrigerator according to claim 24,

wherein the protection means **(29)** controls inverter controlling means **(26)** for driving the compressor **(1)** to perform a protective operation of the compressor **(1)**.

26. The refrigerator according to claim 25,

wherein the protection means **(29)** controls the inverter controlling means **(26)** to perform the protective operation of the compressor **(1)** in preference to operation control of the refrigerant circuit.

27. The refrigerator according to claim 24, further comprising:

switching means for switching from the protective operation of the

protection means **(29)** to a steady operation, based on the information on the internal condition of the compressor **(1)** which has been predicted by the prediction means **(28)**.

28. The refrigerator according to claim 24,

wherein the protection means **(29)** makes a failure diagnosis on the compressor **1**.

29. The refrigerator according to claim 28, further comprising:

memory means **(21)** for memorizing the result of the diagnosis made by the protection means **(29)**.

30. The refrigerator according to claim 24,

wherein the protection means **(29)** is so formed as to forecast a failure in the compressor **(1)**.

31. The refrigerator according to claim 30, further comprising:

communication means **(31)** for outputting information on the forecast made by the protection means **(29)**.

32. The refrigerator according to claim 24,

wherein the protection means **(29)** is so formed as to alter the control content or control parameter of the refrigerant circuit.

33. The refrigerator according to claim 6,

wherein a refrigerant system model for the refrigerant circuit is provided beforehand, and the operating condition of the refrigerant circuit is predicted based on information on the internal condition of the compressor **(1)** predicted by the prediction means **(28)**.

34. The refrigerator according to claim 7,

wherein the motor **(6)** is a brushless DC motor, and

wherein the prediction means **(28)** predicts a motor temperature from the

current and voltage of the motor **(6)** and instrument constants.

35. The refrigerator according to claim 7,

wherein the motor **(6)** is a brushless DC motor,

wherein the identification means **(20)** identifies a parameter based on a motor model constituted by the current and voltage of the motor **(6)**, resistance and inductance, and

wherein the derivation means **(21)** derives motor temperature based on the parameter identified by the identification means **(20)**.

36. The refrigerator according to claim 35,

wherein the identification means **(20)** obtains a motor voltage equation in such a way that a d-axis is plotted in the direction of the N pole of magnets **(1b)** of the motor **(6)**, a q-axis is plotted in the direction which is shifted forward from the d-axis by $\pi/2$, and a motor basic voltage equation for a three-phase PMSM is converted into a d, q axis coordinate system which rotates at an electric angular speed ω, and the identification means **(20)** then identifies a magnetic flux characteristic value associated with an armature flux linkage generated by the magnets **(1b)**, using said motor voltage equation, and

wherein the derivation means **(21)** derives the temperature of the magnets **(1b)** as motor temperature based on the magnetic flux characteristic value identified by the identification means **(20)**.

37. The refrigerator according to claim 36,

wherein the identification means **(20)** obtains a voltage equation for a steady state from the motor voltage equation, and at the time of the identification, the d-axis component of the armature current of said steady-state voltage equation is set to zero.

38. The refrigerator according to claim 35,

wherein the refrigerant circuit has refrigerant detecting means **(24)** for detecting the temperature of a discharge pipe of the compressor **(1)**, and

wherein calibration means **(36)** is configured such that the motor temperature derived by the derivation means **(21)** being regarded as the internal temperature of the compressor **1**, the internal temperature derived by the derivation means **(21)** is calibrated based on the discharge pipe temperature detected by the temperature detecting means **(24)**.